

IN THE CLAIMS:

1. A method of driving a motor emulating advancement of a speed sensor,
comprising:

calculating an emulated advancement time based on the motor's efficiency;

5 measuring a motor speed utilizing a tachometer signal transmitted from a speed sensor;

subtracting the emulated advancement time from the motor speed to generate a
commutation countdown time; and

commutating outputs from a controller to the motor when the commutation countdown
time has elapsed.

10 2. The method of claim 1, further including measuring an actual advance time, the
actual advance time being a time between the commutating of the outputs and a receipt by the
controller of a next speed sensor interrupt.

3. The method of claim 2, further including calculating an anticipated motor speed
by adding the actual advance time to the commutation countdown time.

15 4. The method of claim 3, further including

(a) calculating a new commutation countdown time by subtracting the emulated
advancement time from the anticipated fan speed;

(b) commutating outputs from the controller when the new commutation countdown time
has elapsed;

20 (c) measuring the actual advance time between the commutating of the outputs and the
next speed sensor interrupt;

(d) calculating the anticipated motor speed by adding the actual advance time to the new
commutation countdown time; and

continuing the steps (a), (b), (c), and (d) until the anticipated motor speed is lower than a pre-determined motor speed threshold.

5 5. The method of claim 4, further including decrementing the emulated advancement time by a pre-determined advancement time to create a decremented emulated advancement time if the anticipated fan speed is lower than a pre-determined fan speed threshold;

calculating the new commutation countdown time by subtracting the decremented emulated advancement time from the anticipated fan speed;

commutating the outputs from the controller when the new commutation countdown time has elapsed;

10 measuring the actual advance time, the actual advance time being the time between the commutating of the outputs from the controller and the receipt by the controller of the next hall sensor interrupt; and

calculating the anticipated motor speed by adding the actual advance time to the new commutation countdown time.

15 6. A method of initializing neutral commutation, comprising:

initializing a first driving signal to drive a motor;

receiving a tachometer signal from a speed sensor for the motor;

calculating a motor speed based on the received tachometer signal;

20 calculating a commutation countdown value by subtracting an initial advancing time from the calculated motor speed if the calculated motor speed is lower than a minimum pre-determined speed threshold; and

commutating outputs to the motor including generating a second driving signal if the commutation countdown value has elapsed.

7. The method of claim 6, further including measuring an actual advance time as a period between the commutating of the outputs and a receipt of a next speed sensor interrupt.

8. The method of claim 7, further including creating an anticipated motor speed by adding the actual advance time to the commutation countdown time.

5 9. The method of claim 8, further including determining if the initial advancing time is less than a threshold advancing time.

10. The method of claim 9, further including

(a) creating a new advancing time by adding an incremental advancing time to the initial advancing time if the initial advancing time is less than the threshold advancing time;

10 (b) calculating a new commutation countdown time by subtracting the new advancing time from the anticipated motor speed;

(c) commutating the outputs including generating the first drive signal when the new commutation countdown time has elapsed;

15 (d) measuring the actual advance time between the commutating of the outputs and the next speed sensor interrupt;

(e) creating a new anticipated motor speed by adding the actual advance time to the new commutation countdown time, and

repeating steps (a), (b), (c), (d), and (e) until the new advancing time is greater than threshold advancing time.

20 11. A method of emulating advancement of a speed sensor, comprising:

calculating an advancement time based on a motor's efficiency;

utilizing a tachometer signal transmitted from a speed sensor for the motor to generate a calculated motor speed;

subtracting the advancement time from the calculated motor speed to generate a
commutation countdown time; and

commutating outputs from a controller to the motor when the commutation countdown
time has elapsed.

5 12. The method of claim 11, further including

(a) utilizing the tachometer signal transmitted from the speed sensor at a new
measurement time to generate the calculated motor speed,

(b) calculating a new commutation countdown time by subtracting the advancement time
from the calculated motor speed;

10 (c) commutating outputs to the motor from the controller when the new commutation
countdown time has elapsed; and

continuing the steps (a), (b), and (c) until the calculated motor speed is lower than a pre-
determined motor speed threshold.

13. A method of initializing neutral commutation, comprising:

15 initializing a first driving signal to drive a motor;

receiving a tachometer signal from a speed sensor for the motor;

calculating a motor speed based on the received tachometer signal;

calculating a commutation countdown value by subtracting an initial advancing time
from the calculated motor speed if the calculated motor speed is lower than a minimum pre-

20 determined speed threshold; and

commutating outputs to the motor, including generating a second driving signal, if the
commutation countdown value has elapsed.

14. The method of claim 13, further including determining if the initial advancing time is less than a threshold advancing time.

15. The method of claim 14, further including

(a) creating a new advancing time by adding an incremental advancing time to the initial
5 advancing time if the initial advancing time is less than the threshold advancing time;

(b) calculating a new commutation countdown time by subtracting the new advancing time from the calculated motor speed;

(c) commutating the outputs to the motor, including generating the first drive signal when the new commutation countdown time has elapsed, and

10 repeating steps (a), (b), and (c) until the new advancing time is greater than threshold advancing time.

16. A microcontroller to drive a motor, comprising:

a speed determination module to receive a tachometer signal from a speed sensor for the motor, to generate a calculated motor speed from the tachometer signal, and to transmit the
15 calculated motor speed;

an advancing analyzation module to receive the calculated motor speed, to calculate a commutation countdown time by subtracting an advancement time from the calculated motor speed, and to transmit the commutation countdown time,

a counting module to receive the commutation countdown time, and to transmit a
20 commutation signal once the commutation countdown time has expired; and

a commutation output module to receive the commutation signal and to switch outputs of the microcontroller to the motor upon receipt of the commutation signal.

17. The microcontroller of claim 16, wherein the commutation output module notifies the advancing analyzation module that the outputs to the motor are switched, the advancing analyzation module transmits a second signal to the counting module to begin an actual advance count, the speed determination module transmits a signal identifying that a next speed sensor interrupt has been received, and the counting module stops the actual advance count upon receipt of the next speed sensor interrupt.

18. The microcontroller of claim 17, wherein an anticipated motor speed is calculated by adding the commutation countdown time and the anticipated motor speed.

19. The microcontroller of claim 16, further including, after the commutation of the microcontroller outputs, the speed determination module determining the calculated motor speed for a new measurement time, and transmitting the calculated motor speed for the new measurement time to the advancing analyzation module; and

the advancing analyzation module calculating the commutation countdown time for the new measurement time by subtracting the advance time from the calculated motor speed.

20. The microcontroller of claim 19, wherein the speed determination module utilizes a second counting module to determine the calculated motor speed.

21. A device driven by a motor, comprising:

a driving device to receive a driving signal and to transmit the driving signal;

a motor to receive the driving signal and to operate the device based on the driving

signal;

a speed sensor to monitor the speed of the motor and to transmit a tachometer signal; and

a microcontroller to receive the tachometer signal and to generate the driving signal,

including,

a speed determination module to receive the tachometer signal from the speed sensor, to generate a calculated device speed from the tachometer signal, and to transmit the calculated motor speed;

an advancing analyzation module to receive the calculated motor speed, to
5 calculate a commutation countdown time by subtracting an advancement time from the calculated motor speed, and to transmit the commutation countdown time,

a counting module to receive the commutation countdown time, and to transmit a commutation signal once the commutation countdown time has
10 expired; and

a commutation output module to receive the commutation signal and to switch outputs of the driving signal generated by the microcontroller upon receipt of the commutation signal.

22. The device of claim 21, wherein the commutation output module notifies the
15 advancing analyzation module that the outputs are switched, the advancing analyzation module transmits a second signal to the counting module to begin an actual advance count, the speed determination module transmits a signal identifying that a next speed sensor interrupt has been received, and the counting module stops the actual advance count upon receipt of the next speed sensor interrupt.

23. The device of claim 22, wherein an anticipated motor speed is calculated by adding
20 the commutation countdown time and the anticipated motor speed.

24. The device of claim 21, further including, after commutation of the microcontroller outputs, the speed determination module determining the calculated motor speed for a new

measurement time, and transmitting the calculated motor speed for the new measurement time to the advancing analyzation module, and

the advancing analyzation module calculating the commutation countdown time for the new measurement time by subtracting the advance time from the calculated motor speed.

5 25. A computer-readable medium having encoded thereon a computer-readable program code which when executed causes a microcontroller to:

calculate an emulated advancement time based on a motor's efficiency;

measure a motor speed utilizing a tachometer signal transmitted from a speed sensor for the motor;

10 subtract the emulated advancement time from the motor speed to generate a commutation countdown time; and

commutate outputs from a controller when the commutation countdown time has elapsed.

26. The computer readable medium of claim 25, further having encoded thereon computer readable program code, which when executed causes the microcontroller to

15 measure an actual advance time, the actual advance time being a time between the commutating of the outputs and a receipt by the controller of a next speed sensor interrupt.

27. The computer readable medium of claim 26, further having encoded thereon computer readable program code, which when executed causes the microcontroller to calculate an anticipated motor speed by adding the actual interrupt time to the commutation countdown

20 time.

28. A computer-readable medium having encoded thereon computer-readable program code which when executed causes a microcontroller to:

initialize a first driving signal to drive a motor;

receive a tachometer signal from a speed sensor for the motor;

calculate a motor speed based on the received tachometer signal;

calculate a commutation countdown value by subtracting an initial advancing time from the calculated motor speed if the calculated motor speed is lower than a minimum pre-

5 determined speed threshold; and

commutate outputs for the motor, including generating a second driving signal if the commutation countdown value has elapsed.

29. The computer-readable medium of claim 28 further having encoded thereon computer-readable program code, which when executed causes the microcontroller to measure
10 an actual advance time as a period between the commutating of the outputs and a receipt of a next speed sensor interrupt.

30. The computer-readable medium of claim 29 further having encoded thereon computer readable program code, which when executed causes the microcontroller to create an anticipated motor speed by adding the actual advance time to the commutation countdown time.